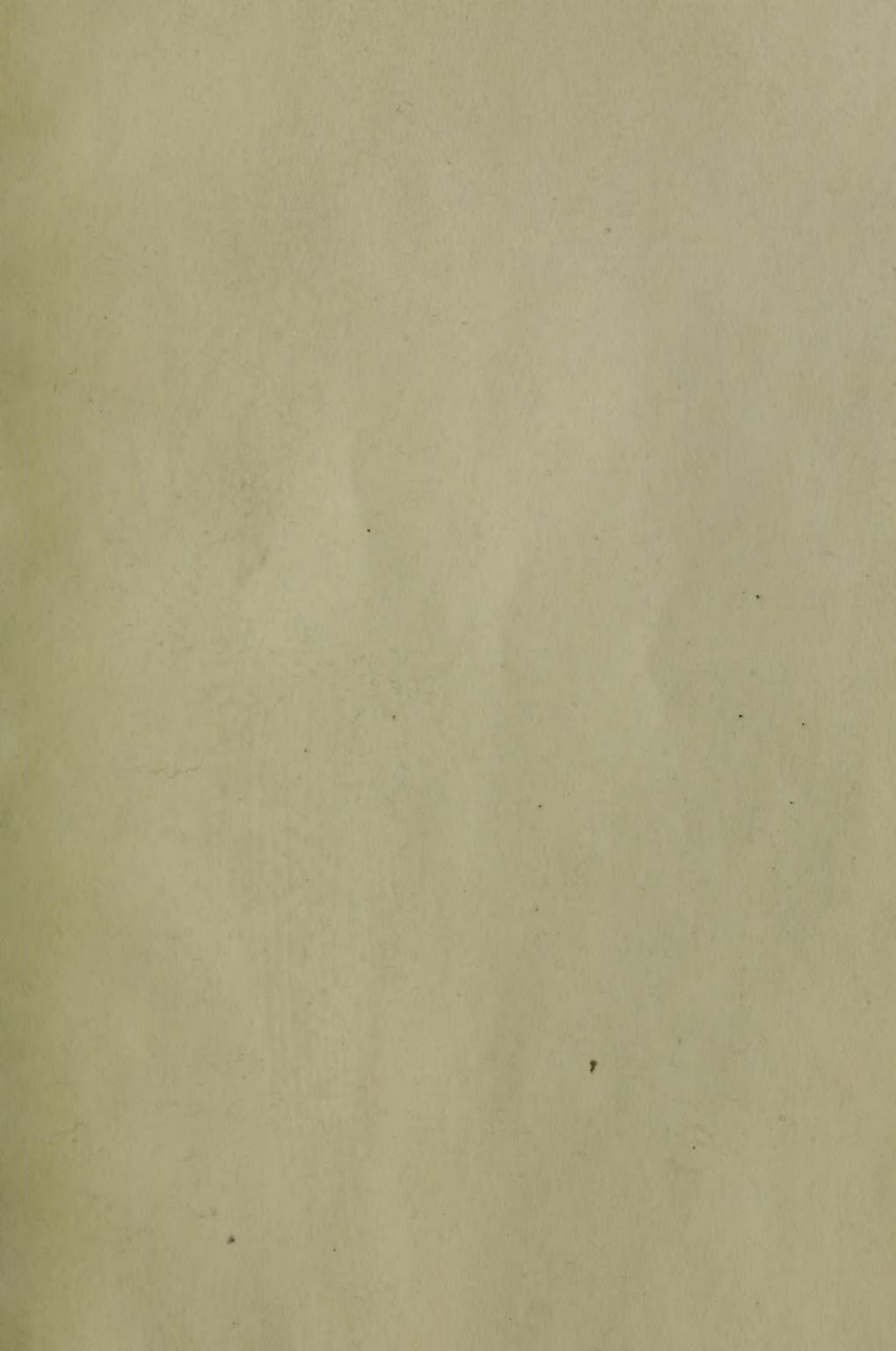


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Transactions.

MUSEUM
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NATURAL
HISTORY

LEEDS NATURALISTS' CLUB
AND
SCIENTIFIC ASSOCIATION.

LIST OF PAPERS AND MEETINGS,
ABSTRACTS OF ANNUAL REPORTS,
AND
LIST OF MEMBERS.

1891-1897.

VOL. III.



LEEDS:
CHORLEY & PICKERSGILL, THE ELECTRIC PRESS, COOKRIDGE STREET.

1898.

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NOTE.

It has been thought desirable by the Council to publish, for the information of members, the list of papers read before the Club during the past six years. An abstract of the papers will usually be found in the "Leeds Mercury Weekly Supplement" for the Saturday following the date on which the papers were read. In future it is proposed to publish in full such papers as the Council may direct, together with the proceedings of each meeting of the Club. Members desirous of having their papers published must submit a copy of the same to the Council for approval. Generally the papers published in extenso will be such as record original observations or discoveries in the domain of Natural Science.

The Council regret that the want of funds has prevented the publication of Transactions annually for the past six years, but hope that in future the necessary support will be forthcoming to enable them to do so.

FEBRUARY, 1898.

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ABSTRACTS OF ANNUAL REPORTS.

1891-1897.

1891.—Eighteen new members were elected during the year. There were 213 members on the roll, of which 15 were honorary members, and 197 ordinary members.

The Treasurer's Accounts showed a balance of £30 12s. 5d. to the credit of the Club, after discharging all outstanding accounts.

Thirty-six meetings were held during the year, of which 10 were held at the Philosophical Hall, 6 at the Medical Department of the Yorkshire College, and the remainder at the Club's Rooms.

Excursions were conducted to Sheffield, Knaresborough and Plumpton, Adel, Boroughbridge and Aldborough. In the excursion to Sheffield the Club had the advantage of the able guidance of Mr. William White, Curator of the Ruskin Museum; and at Aldborough, Dr. Leadman, F.S.A., was an invaluable guide.

The Scientific Apparatus of the Club received a valuable addition in the shape of an excellent Microscope and accessories, the gift of Mr. F. W. Branson, Vice-President; and two objectives (a Swift's 1-inch, and a Zeiss D) were acquired out of the Club's funds.

The formal transfer of the Club's Library to the care of the Public Library Committee of the Corporation of Leeds, took place on the 11th June, and arrangements were completed for the issue of books to members for home use.

The following rules were suggested by the Corporation and agreed to by this Council:—

1.—Books will be issued for home reading to any member of the Leeds Naturalists' Club on the production of his ticket of membership, and on the member signing one of the forms in use in the Reference Library.

2.—The time allowed for reading is 14 days, subject to renewal.

3.—If the Borrower has not finished reading the Book at the end of the Fortnight, he can renew it, without the necessity of returning it, by calling at the Library, or by sending a post card, quoting class letter and number. The renewal may be repeated until the book is done with, unless another borrower enquires for it, when it can only be renewed once after such enquiry.

4.—Borrowers detaining books beyond the time allowed (14 days) for reading will be fined ONE PENNY per WEEK or portion of a WEEK for the first FORTNIGHT, when the Fine will be increased to TWOPENCE per WEEK until the Work is returned. At the end of the FOURTH WEEK application will be made to the borrower for the return of the book or the value thereof; and, in case of refusal, proceedings will be taken to recover the same.

During the past few years the undertaking of naming the plants in the public parks of Leeds had been a subject of discussion. A Sub-Committee of the Council conferred with Mr. Ald. Scarr, the Chairman of the Parks' Committee, with the result that the Council arranged that the Club should undertake the work in the first instance, so far as Roundhay Park was concerned, upon receiving a grant from the Corporation to cover the cost of the necessary labels. This arrangement was afterwards confirmed by an official letter from Sir George Morrison.

The Council, while regretting the loss of a valuable member of the Club, congratulated Mr. W. E. Collinge, the Curator and Librarian, on his appointment as Demonstrator in Biology under Professor Mackintosh, at St. Andrew's University.

1892.—The total number of members was 220, including 14 honorary members; 23 new members were elected during the year.

The Honorary Treasurer's accounts showed a balance of £5 9s. 7d. in favour of the Club.

Twenty-four meetings were held during the year—4 at the Philosophical Hall, 15 at the Club's Room, 80, Municipal Buildings, and 5 at the Yorkshire College.

Excursions were conducted to Fulneck, Masham, Adel Bog, and Kippax; also a Marine Excursion to Scarborough and Filey, in addition to those arranged by the Yorkshire Naturalists' Union.

In connection with the Marine Excursion to Scarborough and Filey, the Council acknowledged their indebtedness to Major J. W. Woodall, M.A., J.P., F.G.S., of Scarborough, who, as on former occasions, very generously placed his steam yacht at their disposal ; and also the valuable assistance of Dr. C. G. Wheelhouse, of Filey.

The best thanks of the Club were given to Dr. H. J. Johnson-Lavis, M.D., M.R.C.S., B.-ès-Sc., &c., of Naples, for his admirable Lecture on "The History and Geology of Vesuvius," which was specially valuable owing to the authority with which the Lecturer is entitled to speak on the subject, which has been his life-study, and to Lord Masham of Swinton, Major-General the Right Honourable John Clifton Cowell, K.C.B., Sir Robert Tempest, Bart., John Cliff, Esq., James Carter, Esq., M.B.O.U., Octavius Eddison, Esq., and R. W. Eddison, Esq., for permission to visit their grounds on the occasion of the excursions, and to the Rev. T. W. Titterington and Thomas Pratt, Esq., M.R.C.V.S., for their kindness in conducting excursions.

The following additions were made to the Library :— Cooke's "Desmids"; Lee's "Microtomist's Vade-Mecum"; Carpenter—"The Microscope and its Revelations," 2nd ed., edited and revised by Dr. Dallinger.

The following were presented :— British Association Reports—Cardiff Meeting ; Mr. W. E. Collinge—On the Preservation of Teleostean Ova ; Mr. E. R. Waite, F.L.S.—"Vertebrates of the Western Ainsty" (Yorkshire) ; Mr. W. Paul—"On Germs."

The work undertaken by the Club of Labelling the Trees and Shrubs in Roundhay Park was completed so far as the pecuniary grant of the Leeds County Council would permit. Most of the conspicuous native trees in the Park were provided with a label.

The Council announced the departure from Leeds of Mr. Edgar R. Waite, F.L.S., who had accepted an important appointment in the Australian Museum, Sydney, New South Wales. Mr. Waite had long been a hard-working, energetic member of the Society, and the Council, on wishing him well,

expressed the hope that he would find in his new work an occupation congenial to his tastes, and at the same time one that would give him ample scope for the exercise of those faculties which in the past had made his work so successful.

The Council, in consideration of the very valuable services rendered to the Society by Professor L. C. Miall, F.R.S., unanimously recommended his election as an honorary member of the Association.

1893.—The number of members on the roll was 197, of whom 14 were elected during the year.

A very successful conversazione was held on Tuesday, the 28th November, at the Philosophical Hall, at which 216 members and their friends were present.

Twenty-one meetings were held during the year, not including the excursions. Of these 8 were held in the Library of the Philosophical Hall, 10 in the Club's Room, No. 80, Municipal Buildings, 1 at the Yorkshire College, and 1 in the Church Institute.

Highly successful and largely attended excursions were made to Adel; Mr. John Wood's Nurseries (Kirkstall); Messrs. Jas. Backhouse & Son's Nurseries (York); Swillington; Ripon; Middleton; Knaresborough and Staveley.

The Council found that short evening excursions in place of meetings during the summer months met with the support of the members, that to Mr. John Wood's nurseries at Kirkstall being largely attended and proving a most interesting visit.

The following books were acquired by purchase during the year:—Freshwater Algae of East India, by W. Barwell Turner, F.R.M.S.; The Naturalist; Science Gossip.

The Hon. Curator acknowledged the gift of some most interesting and valuable specimens of gold and silver ores from California by Mr. P. G. Dawson, an old member of the Club.

During the year new cases for preserving the Bird Skins in the Club's Museum were provided.

The Council thanked Mr. John Cordeaux, M.B.O.U., for his excellent paper on Bird Migration, and Mr. Norman Walker for his papers and demonstrations; also all those ladies and gentlemen who so kindly assisted at the Conversazione; and the following gentlemen, who lent great and valuable help on the excursions:—Thos. Pratt, M.R.C.V.S. (Ripon), B. M. Smith (Ripon), Rev. E. P. Knubley, M.A. (Staveley), George Webster (York), Rev. Robt. Elmhurst (Farnham); and the following for permission to visit their grounds:—John Wood (Kirkstall), J. Dent Dent (Ribston), Hy. Mason (Steward to the Marquis of Ripon), James Backhouse & Son (York), Wm. Paul (Adel), Mrs. Shiffner (Copgrove).

The Club was again enrolled among the Corresponding Societies of the British Association, and was represented at the meeting at Nottingham by the President.

The Publications Committee presented a report, which was approved by the Council, that there shall be a publication of the Transactions every year before the beginning of the following year's meetings; that such publications shall consist of several selected papers printed in full or abstract form, together with a record of the work done during the year.

Application was made to the Parks Committee of the Leeds City Council for a further grant to cover the expenses of purchasing labels for the continuance of the valuable work of labelling the trees and shrubs in Roundhay Park.

The Hon. Treasurer's accounts showed the Club to be in a satisfactory financial condition.

The Council congratulated Prof. Ed. E. Prince, B.A., F.L.S., an old member of the Club, on his appointment by the Canadian Government to the important post of Commissioner of Fisheries for the Dominion of Canada, and Mr. Percy H. Grimshaw on being appointed an assistant in the Edinburgh Museum.

1894.—The number of members on the Roll was 170, of whom 5 were elected during the year.

The Honorary Treasurer's accounts showed a satisfactory financial condition.

Twenty-nine meetings, not including the excursions, were held during the course of the year. Of these 7 were held in the Library of the Philosophical Hall, 1 at the Yorkshire College, and 5 in the Club's Room.

Excursions were arranged on the Saturdays during the summer months, and were well attended, the following being the localities visited :—Ripon, Malham, Pool, Plumpton Rocks, Burley-in-Wharfedale, Adel Bog, Walton Hall (Wakefield).

In connection with the excursions, the thanks of the Society were given to the following societies and gentlemen for valuable co-operation :—The Ripon Naturalists' Club, The Craven Naturalists' Association, The Wakefield Naturalists' Society, Thomas Pratt, M.R.C.V.S. (Ripon), B. M. Smith (Ripon), J. J. Wilkinson (Skipton), William Story (Pool), Jas. Breare (Burley), D. Grimshaw (Burley), Wm. Rushforth (Wakefield), H. B. Williamson (Wakefield); and to the following gentlemen for kind permission to visit their estates :—H. Bilson Martin (Agent for the Duke of Devonshire), Thomas S. Mason (Agent for the Marquis of Ripon), John Mason (Agent for Lord Grantley), Sir J. P. P. Radcliffe (Rudding Park), W. Morrison, J.P. (Malham), W. Paul (Adel), J. Binns (Sawley Hall), E. Simpson (Walton Hall), W. H. Bartholomew.

The Club was again enrolled among the Corresponding Societies of the British Association, and the President was elected to represent the Club at the meeting at Oxford.

The President and Messrs. Branson, Crowther, and Wilson were elected as delegates of the Club to the Yorkshire Naturalists' Union.

The Council considered the advisability of creating a new class of associate members, being pupils and pupil-teachers at the various schools in the city, and it was decided that a limited number of such associates should be admitted. A circular to that effect was issued to the head-masters and head-mistresses of 250 schools.

1895.—The number of members on the Roll was 179, including honorary members; 30 new members were elected during the year.

Seven meetings were held in the Library of the Leeds Philosophical and Literary Society, and nine in the Club's Room.

By the kindness of the Corporate Property Committee of the Leeds City Council, the meeting on October 18th, when a paper on "Recent Researches on Bacteria" was delivered by H. Wager, F.L.S., was held in the Law Library of the Town Hall.

Excursions took place to Askham Bog, Grassington, Hebden Bridge.

The following additions were made to the Library:—The Life-History of *Pericoma*, by L. C. Miall, F.R.S., and Norman Walker; Observations on *Dendrolagus Bennetianus*, Edgar R. Waite, F.L.S.; Re-description of *Aspidites Ramsayi*, Edgar R. Waite, F.L.S.; Proceedings of Yorkshire Geological Polytechnic Society; Transactions of Leeds Geological Association; Transactions of Chester Natural History Society; Transactions of Brighton and Sussex Natural History Society.

The thanks of the Council were given to Mr. J. J. Wilkinson for his paper on "Spiders and Flies," and to the Halifax Scientific Society and the Craven Naturalists' Association for the kind assistance and co-operation on excursions in their districts, and to Mr. J. Easton Wilkinson for permission to visit Askham Bog.

By the kind invitation of the Mayor of Leeds a Reception and Conversazione was held in the Mayor's Rooms, in the Town Hall, on the 25th September. There was a very large attendance of members, and some very interesting exhibits were shown.

A very successful conversazione was held in the rooms of the Leeds Philosophical and Literary Society, on February 13th. There was, as usual, a large attendance of members and friends, and the exhibits were specially interesting.

The Club is indebted to Professor Arthur Smithells, B.Sc., F.I.C., for his demonstration of "Argon," and to the President for exhibiting the Kinetoscope, and to the Public Library Committee of the City Council for the loan of Muybridge's "Animal Locomotion."

The Honorary Treasurer's accounts showed a very satisfactory financial condition.

Mr. Washington Teasdale, a former president of the Club, was elected an honorary member during the year. Mr. Teasdale was an original member of the Club, and for many years did valuable work both at Council and ordinary meetings. Mr. Teasdale contributed some valuable communications and exhibits to meetings during the year.

The Council called the attention of members to the series of meetings devoted to Pond-Life, held in the Spring Session, and to the series of practical demonstrations of Botanical types inaugurated in the Session. This latter series will be continued next Autumn Session. By organising a progressive series of papers on one subject it was hoped that young members might be induced to take up the study of the subject selected.

The opinion was expressed that much assistance might be rendered to one another by the Scientific Societies of Leeds in arranging joint meetings, when papers mutually interesting might be read. This was done in one instance during the year.

The Club was again elected a Corresponding Society of the British Association, and Mr. Harold Wager, F.L.S., was appointed delegate. The Club also remained affiliated to the Yorkshire Naturalists' Union, and the Council appointed the President and Messrs. H. Wager, F.L.S., H. Crowther, F.R.M.S., and H. B. Wilson as delegates for the Annual Meeting at York.

On the invitation of the Council, supported by the Leeds Geological Association and the Leeds Co-operative Field Club, the Yorkshire Naturalists' Union decided to hold the Annual Meeting for 1896 at Leeds.

1896.—The number of members on the Roll was 181, of whom 20 were elected during the year.

During the year 11 meetings were held in the Philosophical Hall and 2 meetings in the Club's Room.

The following additions were made to the Library :—
 The Naturalist, 1896 ; Science Gossip, 1896 ; Transactions of Yorkshire Naturalists' Union, Part 19 ; Transactions of North Staffordshire Naturalists' Field Club, 1895 ; Journal and Transactions of the Leeds Astronomical Society, No. 3 ; Annual Report of the Sheffield Naturalists' Club ; British Association "Report of Conference of Delegates of Corresponding Societies held at Liverpool"; Report of the Yorkshire Ramblers' Club ; British Museum Handbook, "An Introduction to the Study of Rocks"; British Museum Handbook, "Guide to British Mycetozoa" ; "On the Structure of the Root," H. Wager, F.L.S., and N. Walker.

During the summer months excursions were made to Parlington Park, Knaresborough, and Easington in Holderness.

The best thanks of the Council were given to Colonel Gascoigne and his agent, Mr. T. Herbert Prater, for permission given and assistance rendered in visiting Parlington Park ; also to Mr. Sykes, of Cookridge Towers, for the invitation given to the members of the Council to see his very extensive collection of Alpine and other plants.

The Council congratulated Mr. Wm. Falconer (who had served on the Council for two years) on his promotion to a more important position, and expressed their regret at the loss to the Club, by his removal from the district, of a valuable worker and an excellent botanist.

On the opening meeting of the Session on March 4th, the President, supported by Messrs. Peter Gilston, ex-Mayor of Leeds, Jno. Cordeaux, President of Yorkshire Naturalists' Union, and David Forsyth, M.A., D.Sc., strongly urged the consideration of the question of the amalgamation of the various Scientific Societies in Leeds (some fifteen in all) into an "Institute of Science," having one building, and one aim in spreading scientific truth,

but without destroying the individuality of any Society. A Joint Committee of the various Societies interested in a project on these lines, on which this Club was represented by its President and Secretary, was formed, and some action taken.

The Club's delegates to the Yorkshire Naturalists' Union offered an invitation to the Union to hold its Annual Meeting this year in Leeds, the Geological Association and the Co-operative Naturalists' Field Club of this City joining them in the invitation. A Reception Committee was formed under the chairmanship of the Club's President. The Mayor of the City, Sir James Kitson, Bart., M.P., also extended civic hospitality to the Union by giving a Reception in the City Art Gallery on the evening of November 26th, in connection with which a Conversazione was held. The Council gladly rendered their assistance in making the meeting a success.

The Club was again elected a Corresponding Society of the British Association, and Mr. Harold Wager, F.L.S., was appointed delegate. The Council appointed the President and Messrs. H. Wager, F.L.S., H. Crowther, F.R.M.S., and H. B. Wilson as delegates for the Annual Meeting of the Yorkshire Naturalists' Union at Leeds.

The Honorary Treasurer's accounts showed that the financial affairs of the Club are in a satisfactory condition.

1897.—The number of members on the Roll was 135, of whom 13 were honorary members.

The financial condition was satisfactory, though the Council felt that with an increased Roll of Membership or Annual Subscription the sphere of usefulness of the Club's work might be greatly enlarged.

The Council deeply regretted the loss of the Right Rev. the Lord Bishop of Wakefield (Dr. Walsham How), who, in the midst of his multifarious duties, found time to give the opening address to the Club in February of last year.

The best thanks of the Club were given to H. C. Sorby, LL.D., F.R.S., an honorary member, for his admirable paper on "The Preparation of Marine Animals and Plants

as Transparent Lantern Slides," and also to John Cordeaux, J.P., F.R.G.S., M.B.O.U., for his paper on "The Migration of Birds."

The Council unanimously recommended to the Club the election of John Cordeaux, J.P., F.R.G.S., M.B.O.U., as an honorary member. Mr. Cordeaux has on several occasions addressed the Club on that subject, which he has so deeply studied, and the Council felt that members would be glad to add his name to the other distinguished naturalists who are honorary members of the Club.

Owing to removal from Leeds, J. H. Wilson, D.Sc., F.R.S.E., resigned his position on the Council. This was a loss to the Club, which had benefited largely from Dr. Wilson's short residence in Leeds. H. Crowther, F.R.M.S., also expressed his desire to retire from the Council, where his presence and advice proved most valuable. The Council were pleased to learn, however, that he would still continue to contribute papers from time to time.

The following additions were made to the Library during the year:—Report of the British Association, 1896; "Observations on the Morphology of Species of the Genus *Ulex*," Harold Wager, F.L.S.; "Common Freshwater Shells," Ernest Berry Smith.

The following addition was made to the Club's Museum by presentation:—"Foraminifera," a Series of Microscopic Slides (J. W. Dixon).

At a General Meeting of the Club held on February 10th, the following new rule was adopted:—

"That the name of any member whose subscription is in arrear, or shall become in arrear for two years, shall, after one month's notice in writing from the Honorary Treasurer, be struck off the roll of members, and such member shall thereupon cease to be a member of the Club."

The Council cordially expressed their thanks to W. S. Crowther for his discharge of the duties of Honorary Secretary during the year at considerable personal inconvenience.

LIST OF MEETINGS AND OFFICERS, 1891.

President:

Prof. ARTHUR SMITHILLS, B.Sc., F.I.C., F.C.S.

Vice-Presidents:

Prof. DE BURGH BIRCH, M.D., F.R.S.E.	F. W. BRANSON, F.I.C., F.C.S. J. STUBBINS, F.L.S., F.R.M.S.
Prof. L. C. MIAALL, F.L.S., F.G.S.	

Council:

J. W. ADDYMAN, B.A.	H. B. HEWETSON, M.R.C.S., F.L.S.
J. CHARTERS BIRCH, L.D.S.	HAROLD WAGER, F.L.S.
W. CLAPHAM.	EDGAR R. WAITE, F.L.S.

Hon. Treasurer:

J. PHILLIPS.

Hon. Librarian and Curator:

W. E. COLLINGE.

Hon. Secretary:

ARTHUR WALKER.

- Feb. 2. The Progress of Natural Science—A. Smithells, B.Sc., F.I.C.
- ,, 9. Conchological Notes—W. E. Collinge.
- ,, 17. Medusæ and Cuttle Fish—J. M. Kirk, F.R.M.S.
- ,, 23. The Structure of Animal and Vegetable Cells—Harold Wager.
- Mar. 2. General Natural History Exhibits.
- ,, 9. Examination of Third Day's Chick—Prof. L. C. Miall, F.L.S., F.G.S.
- ,, 16. Diatomaceæ—James W. Addyman, B.A.
- ,, 23. The Structure of a Flower Bud—Harold Wager.
- April 6. Exhibition of Pond Life.
- ,, 13. Preparation of Lepidopterous Larvæ—Edgar R. Waite, F.L.S.
- ,, 20. Fog—The President.
- ,, 25. Excursion to Boroughbridge and Aldborough—Dr. A. D. H. Leadman, F.S.A. (leader).
- ,, 27. Examination of Results.
- May 1. Exhibition of the Low Forms of Vegetation.
Bacteria from Dr. Koch's Laboratory—Dr. Oliver.
- ,, 9. Excursion to Adel and Bramhope.
- ,, 11. Conversational Meeting.
- ,, 25. Conversational Meeting.
- ,, 30. Excursion to Ingleton.
- June 1. Exhibits to illustrate Vegetable Structure.
- ,, 6. Excursion to Rothwell and Middleton.
- ,, 8. Conversational Meeting.
- ,, 15. The Prothallus of a Fern—Harold Wager.
- ,, 20. Excursion to Knaresborough and Plumpton.
- ,, 22. Conversational Meeting.
- ,, 29. Development of the Eggs of Chironomus—Prof. L. C. Miall, F.G.S., F.L.S.
- July 4. Excursion — Sheffield Botanical Gardens and the Ruskin Museum.

July 6. Exhibition—Minerals and Crystals.
 „ 13. Demonstration—Prof. L. C. Miall.
 „ 18. Excursion to Askham Bog.
 „ 20. Conversational Meeting.
 „ 27. Preparation of Lepidopterous Larvæ—Edgar R. Waite, F.L.S.

Sept. 7. Exhibits and Conversation.
 „ 14. „ „
 „ 21. „ „
 „ 28. „ „

Oct. 5. Foul Air—The President.
 „ 12. Exhibition of Animal Sections with Lantern Microscope—E. H. Jacob, M.A., M.D.
 „ 19. Exhibition of Vegetable Sections with Lantern Microscope—W. West, F.L.S.
 „ 26. How Plants Spread—Percy H. Grimshaw.

Nov. 2. The Colouring Matter of Plants—Harold Wager.
 „ 9. Muscle—Prof. de Burgh Birch, M.D., C.M., F.R.S.E.
 „ 16. Boroughbridge and Aldborough with Lantern Illustrations—Dr. A. H. D. Leadman, F.S.A.
 „ 23. Great Locust Plague, 1891, illustrated by Specimens and Lantern Slides taken in Morocco—H. Bendelack Hewetson, M.R.C.S., F.L.S.
 „ 30. Microscopical Exhibits.

Dec. 7. Annual Meeting.

1892.

President :

ARTHUR SMITHELLS, B.Sc., F.I.C.

Vice-Presidents :

DE BURGH BIRCH, M.D., C.M., F.R.S.E.	F. W. BRANSON, F.I.C.
L. C. MIALL, F.L.S., F.G.S.	J. STUBBINS, F.G.S., F.R.M.S.

Council :

J. W. ADDYMAN, B.A.	DAVID FORSYTH, M.A., D.Sc.
J. CHARTERS BIRCH, L.D.S.	HAROLD WAGER.
W. CLAPHAM.	EDGAR R. WAITE, F.L.S.

<i>Hon. Treasurer :</i>	<i>Hon. Librarian and Curator :</i>
J. PHILLIPS.	OLIVER MARSDEN.

Hon. Secretaries :

ARTHUR WALKER. PERCY H. GRIMSHAW.

Feb. 10. Spectrum Analysis (with experiments)—The President (Prof. A. Smithells, B.Sc., F.I.C.)
 „ 15. Dissection of a Bird-Type—E. R. Waite, F.L.S.
 „ 22. The Defences of Animals (with Lantern Illustrations)—Edgar R. Waite, F.L.S.

Mar. 7. Exhibition of Natural History Specimens and Objects of Scientific Interest.

Mar. 14. *Amphioxus*—Norman Walker.
 , , 28. *Amphioxus*—Norman Walker.

April 4. Lecture—Morocco (around Tangiers): Its Manners and Customs, Slavery, Religion, Trades, Anthropology, and General Natural History, illustrated by a Large Series of Lantern Slides and Photographs (recently taken by the Lecturer)—H. Bendelack Hewetson, F.L.S., F.Z.S., M.R.C.S.

, 11. Sense Organs of the Blow-Fly—O. Marsden.

May 9. Leaf-buds and Leaf Development—Harold Wager.
 , 21. Excursion to Fulneck.
 , 23. Examination of Results of Excursion

June 13. The Moss Plant—Harold Wager.
 , 15. Excursion to Masham.
 , 25. Excursion to Adel Bog.
 , 27. Examination of Results of Excursions.

July 11. Leaf Development—Harold Wager.
 , 23. Excursion to Kippax.
 , 25. Examination of Results of Excursion to Kippax.

Sept. 5. Exhibit of Natural History Specimens.
 , 10. Excursion to Adel.
 , 12. Examination of Results of Excursion to Adel.
 , 24. Marine Excursion to Filey. (By the kindness of Major Woodall, M.A., J.P., F.G.S., his steam yacht was placed at the disposal of members for dredging.)

Oct. 3. The History and Geology of Vesuvius—L. H. J. Johnston-Lavis, M.D., M.R.C.S., B.-es-Sc., etc.
 , 10. Conversational Meeting.
 , 17. Exhibition of Microscopic Objects.
 , 24. British Reptiles (with living illustrations)—Edgar R. Waite, F.L.S.

Nov. 7. Exhibition of Injurious Insects and Fungi, with Introductory Addresses by Harold Wager, F.L.S., Chas. Crossland (Halifax), and H. T. Soppitt (Bradford).
 , 14. Graphic Natural History—Henry B. Wilson.
 , 21. On the Methods of Examining Bacteria, and Some New Observations on their Structure—Harold Wager.

Dec. 7. Annual Meeting; “The Structure of Flame”—A. Smithells, B.Sc., F.I.C.

1893.

President:

HAROLD WAGER, F.L.S.

Vice-Presidents:

ARTHUR SMITHELLS, B.Sc., F.I.C.	F. W. BRANSON, F.I.C.
DE BURGH BIRCH, M.D., C.M., F.R.S.E.	JOHN STUBBINS, F.G.S., F.R.M.S.

The Council:

J. W. ADDYMAN, B.A.

DAVID FORSYTH, M.A., D.Sc.

W. LOWER CARTER, M.A., F.G.S.

T. T. GROOM, B.A., B.Sc.

W. CLAPHAM.

WILLIAM KIRKBY.

Treasurer:

J. PHILLIPS.

Librarian and Curator:

OLIVER MARSDEN.

Secretaries:

ARTHUR WALKER.

H. B. WILSON.

Feb. 20. A Trap to Catch a Sunbeam—The President (Harold Wager).
 , , 27. Action of Sunlight on Formation of Cork—Norman Walker.
 Cirripedes—T. T. Groom, B.A.
 Protozoa as Parasites in Cancer—J. W. Haigh.
 Dissection of a Crab—T. H. Taylor, B.A.

Mar. 6. Exalted Parasitism. Notes on some Curious Cases of Symbiosis. Plants and Animals—Professor Ed. E. Prince, B.A., F.L.S., etc.

, 13. Structure of Gammarus—T. H. Taylor, B.A.

, 20. Practical Demonstration on Plant Mechanics—The President (H. Wager).

, 27. Life at the Surface of the Sea—T. T. Groom, B.A., B.Sc.

April 10. Exhibition of Specimens. Notes on Recent Occurrence of Rare Birds in Holderness, including the addition of two new birds, *Zenotrecia albicollis* and *Tinaria canescens*, to the Yorkshire avi-fauna—John Cordeaux, M.B.O.U., and H. B. Hewetson, M.R.C.S., F.L.S., etc.

, 24. Preparation and Exhibition of Vegetable Section—J. Phillips.

May 6. Excursion to Adel.

, 8. Examination of Results of the Adel Excursion.

, 15. Visit to Mr. John Wood's Nurseries at Kirkstall.

, 29. Results of Whit-Monday Yorkshire Naturalists' Union Excursion and General Exhibits.

, 31. Visit to the Nurseries of Messrs. Jas. Backhouse & Son, York.

June 12. Exhibition of Algae.

, 26. Exhibition of Drawings of "Edible Fungi," by J. W. Haigh and H. Bendelack Hewetson, F.Z.S., F.L.S., etc., and General Exhibits.

July 1. Excursion to Ripon for Sharow Mires and the Canal.

, 3. Examination of Results of the Ripon Excursion.

, 10. Excursion to Middleton, Hunslet.

, 22. Excursion to Knaresborough and Copgrove.

, 24. Exhibition and Examination of the Results of the Middleton and Knaresborough Excursions. Gold and other Ores from California—P. G. R. Dawson.

Oct. 9. The Structure of an Agaricus—The President.

, 16. Demonstration on Methods of Mounting Vegetable Sections—Norman Walker.

, 23. Development of the Tadpole—The President.
 Structure of Hydra—T. H. Taylor, B.A.
 Entomological Exhibits—H. B. Wilson.

Oct. 30. Corals (Ancient and Modern)—W. Lower Carter, M.A., F.G.S., illustrated by Lantern Slides.

Nov. 13. Zoological Demonstration — Life-History and Structure of *Tubifex*—T. H. Taylor, B.A.

„ 24. Conversazione.

Dec. 4. Annual Meeting.

1894.

President :

HAROLD WAGER, F.L.S.

Vice-Presidents :

ARTHUR SMITHILLS, B.Sc., F.I.C. F. W. BRANSON, F.I.C.
 DE BURGH BIRCH, M.D., C.M., JOHN STUBBINS, F.G.S., F.R.M.S.
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T. H. TAYLOR, M.A.	

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Hon. Librarian and Curator :

OLIVER MARSDEN.

Hon. Secretary :

H. B. WILSON.

Assistant Secretary :

NORMAN WALKER.

Feb. 5. Moorland Plants and their Adaptations. Illustrated with Lantern Slides and Specimens—The President (Harold Wager, F.L.S.).

„ 12. Structure and Habits of a Common Weevil—*Cionus scrophulariae*—H. Crowther, F.R.M.S.

„ 19. Demonstrations :— Minerals and Crystals — H. Crowther, F.R.M.S.
 Sea Urchins—M. Walton.
 Fungus (*Ascobolus barbatus*) new to Science found at Leeds—
 The President.

„ 26. Meeting of Botanical Section—The President and Mr. O. Marsden.

Mar. 5. Deep Sea Life, illustrated with Lantern Slides and Specimens—
 T. T. Groom, B.A., B.Sc.

„ 12. Meeting of Zoological Section—Caddis Worms—T. H. Taylor, M.A.

„ 19. Fossil Plants of the Coal Measures—Percy F. Kendall, F.G.S.

April 2. Feathers and Wings. Screen Illustrations and Specimens—
 H. Crowther, F.R.M.S.

„ 9. Numerical Aperture—O. Marsden.
 The part that Lime plays in Nature—H. Crowther, F.R.M.S.

„ 16. The Management of an Aquarium—J. Phillips.
 Mosses—W. Kirkby.

April 23. The Cow Parsnip—T. H. Taylor, M.A., and Norman Walker.
 „ 30. Cuttle Fishes, Ancient and Modern. Illustrated with Lantern Slides and Specimens—T. H. Taylor, M.A.

June 2. Excursion to Bell Busk and Malham.
 „ 4. Examination of Results.
 „ 9. Excursion to Plompton Rocks and Pannal.
 „ 11. Examination of Results.
 „ 16. Excursion to Ripon for the Grantley and Sawley Estates (with the co-operation of the Ripon Naturalists' Club).
 „ 18. Examination of Results.
 „ 23. Excursion to Burley-in-Wharfedale.
 „ 25. Examination of Results.
 „ 30. Excursion to Adel Bog.

July 2. Examination of Results.
 „ 14. Excursion to Walton Park and Ryhill Reservoir, Wakefield.
 „ 21. Excursion to Skipton, for Grassington and Kilnsey.
 „ 23. Examination of Results.

Oct. 15. The Natural History of Water Plants—The President.
 „ 22. Some Peculiar Modes of Insect Respiration—Prof. L. C. Miall, F.R.S.
 „ 29. An Aquatic Insect Larva (*Plectrocnemia*)—T. H. Taylor, M.A.

Nov. 12. Some Points in the Life-History of *Dytiscus*—W. F. Baker, F.E.S.
 „ 19. Exhibits.
 „ 26. Comparison of Terrestrial with Water Fungi—The President.

Dec. 3. Annual Meeting.

1895.

President :

F. W. BRANSON, F.I.C.

Vice-Presidents :

HAROLD WAGER, F.L.S.	JOHN STUBBINS, F.G.S., F.R.M.S.
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H. B. WILSON.

Assistant Secretary :

NORMAN WALKER.

Feb. 13. Conversazione.

„ 22. Bibliography of Pond Life—H. Crowther, F.R.M.S.

Mar. 1. Spiders and Flies. Illustrated by Micro Lantern—J. J. Wilkinson.

„ 15. Pond Life: Insect Life of a Pond—Oliver Marsden.

Caddis Flies—T. H. Taylor, M.A.

April 5. Freshwater Algae—Harold Wager, F.L.S.
 „ 19. Pond Life: A Freshwater Cockle—H. Crowther, F.R.M.S.
 May 3. Cyclonic Storms—The President (F. W. Branson, F.I.C.).
 „ 17. Protective Colouration of the Kingfisher—The President.
 Salmonidæ—H. B. Wilson.
 „ 29. Evening Excursion to Adel.
 „ 31. Results of Excursion.
 June 7. Reproductive Processes in Plants Contrasted—W. West, F.L.S.
 „ 8. Excursion to Askham Bog.
 „ 14. Results of Excursion.
 Pond Life : Life History of Pericoma—N. Walker.
 „ 22. Excursion to Grassington.
 „ 28. Results of Excursion to Grassington.
 Pond Life : Diatoms and Desmids—J. W. Addyman, B.A.
 July 6. Excursion to Hebden Bridge.
 „ 12. Results of Excursion to Hebden Bridge.
 Pond Life : Macro-Botany—W. Falconer.
 Simulated Ice-scratchings on the Gordale Series at Harrogate—Geo. Paul, F.G.S.
 „ 20. Excursion to Pontefract.
 „ 26. Results of Excursion to Pontefract.
 Sept. 25. Reception by the Mayor and Mayoress of Leeds at the Town Hall.
 Oct. 11. Practical Evening: Structure of a Plant Stem—H. Wager, F.L.S., and N. Walker.
 „ 18. Recent Researches on Bacteria—H. Wager, F.L.S.
 Nov. 1. Practical Evening: Structure of the Root of a Flowering Plant—H. Wager, F.L.S., and N. Walker.
 „ 20. Glaciers, with Limelight Illustrations—Percy F. Kendall, F.G.S. (A Joint Meeting with the Leeds Geological Association.)
 Dec. 6. Annual Meeting.

1896.

President:

H. B. HEWETSON, M.R.C.S., F.L.S., etc.

*Vice-Presidents:*F. W. BRANSON, F.I.C.
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H. B. WILSON.*Assistant Secretary:*
NORMAN WALKER.

Mar. 4. Address.—The Nature and Purposes of Naturalist Field Clubs and Scientific Associations—The President (H. Bendelack Hewetson, M.R.C.S., F.L.S., F.Z.S., etc.).

,, 16. Botanical Demonstration: Structure of the Stem of a Flowering Plant—H. Wager, F.L.S., and N. Walker.

,, 30. Protective and Warning Colouration—H. B. Wilson.

April 13. Exhibition of Specimens collected during Easter Holidays.

,, 20. Botanical Demonstration: Structure of a Leaf—H. Wager, F.L.S., and N. Walker.

May 4. Some points in the Life-History of a Pathogenic Micro-organism, with special reference to the Typhoid Bacillus—Professor Trevelyan, M.D.

,, 18. Some Observations on Hybrid Plants, with Limelight Illustrations, from Nature—J. H. Wilson, D.Sc.

June 1. Birds' Eggs and Nests, with a large number of Illustrations and Specimens—H. Crowther, F.R.M.S.

,, 22. Exhibition of Diatoms and Desmids.

July 4. Excursion to Parlington.

,, 18. Excursion to Knaresborough.

Aug. 29. Excursion to Easington-in-Holderness.

Oct. 16. The History of the Sacred Lotus. Limelight Sketches, etc.—Mrs. Parbury.

,, 23. Natural History of the Honey Bee. Lantern Illustrations—Wm. Dixon (Expert to Bee-Keepers' Association).

Nov. 6. Insectivorous Plants. Illustrated by Lantern, etc.—J. H. Wilson, D.Sc., F.R.S.E.

,, 16. Exhibits.

,, 24. Reception of Yorkshire Naturalists' Union.

Dec. 4. Annual Meeting.

1897.

President:

H. BENDELACK HEWETSON, M.R.C.S., F.L.S., F.Z.S., etc.

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J. PHILLIPS.*Hon. Librarian and Curator:*
OLIVER MARSDEN.*Hon. Secretaries:*
H. B. WILSON. W. S. CROWTHER.

Feb. 10. The Growth of Sight—The Right Rev. the Lord Bishop of Wakefield.

,, 24. Slides Illustrating Respiratory Organs of Aquatic Insects—J. J. Wilkinson.

Unfrequented Norway, with Lantern Illustrations—J. W. Addyman, B.A.

Mar. 10. On the Preparation of Marine Animals and Plants as Transparent Lantern Slides. Illustrated by numerous examples—H. C. Sorby, LL.D., F.R.S., etc.

,, 24. Coal Mining in the West Riding. Lantern Slides—F. W. Branson, F.I.C.

April 5. The Structure and Life-History of the Garden Snail. Lantern Illustrations—J. W. Taylor, F.L.S.

,, 26. Exhibition of Objects collected during Easter Holidays. Some of our Common Freshwater Shells, illustrated by numerous specimens—E. B. Smith.

May 3. Descriptive Notes of some British and Continental Botanic Gardens. Lantern Illustrations—J. H. Wilson, D.Sc., F.R.S.E.

June 12. Excursion to Knaresborough.

Oct. 8. Natural History Observations on the Furze Plant—Harold Wager, F.L.S.

,, 22. The Lamprey—T. H. Taylor, M.A.

Nov. 12. The Wild Plants of North America—Harold Wager, F.L.S.

,, 19. Bird Migration—John Cordeaux, J.P., M.B.O.U., F.R.G.S.

Dec. 10. Annual Meeting. The Great Sahara and the Oasis of Biskra—A. E. H. Hammerton.

Exhibits—

- Australian Snakes, from original drawings by Edgar R. Waite, F.L.S., of Sydney.
- Photographs of Nests of British Birds—F. W. Branson, F.I.C.
- British Shells—E. B. Smith.
- British Insects—H. B. Wilson.

LIST OF MEMBERS, JANUARY, 1898.

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BAIRSTOW, Mrs., 33, Cardigan Road, Leeds.
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 FORSYTH, J. A. CAIRNS, 2, Lifton Place, Leeds.
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 HIRST, W., Roundhay Road, Leeds.

IRVINE, C. S., Adel.

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 JAMES, H. B., South Parade, Leeds.
 JACKSON, GEO., 13, Briggate, Leeds.

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 KERSHAW, E. R., 27, Osborne Street, Woodsley Road, Leeds.
 KIRK, E. A., 9, Blandford Gardens, Woodhouse Lane, Leeds.

LUPTON, HY., Lyndhurst, North Grange Road, Leeds.

LUCAS, JOHN, 169, Church Street, Hunslet.

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MARSH, H., 72, Wellington Street, Leeds.

MIDGELEY, E. C., Thorn Lea, Cardigan Road, Leeds.

MARSDEN, OLIVER, 7, Regent Terrace, Hyde Park Road, Leeds.

METCALFE, W. D., 5, Spring Terrace, Ilkley.

MIDDLETON, R. N., 11, Hyde Terrace, Leeds.

MILLAR, JAS., 53, Darley Street, North Street, Leeds.

MACKAY, R., Oak Road, North Lane, Leeds.

NEEDHAM, JOHN, Park Lane, Leeds.

OXLEY, HY., Spenfield, Weetwood, Leeds.

OXLEY, T., 3, Edinbro' Road, Armley, Leeds.

PHILLIPS, JOSEPH, 16, Alexandra Crescent, Leeds.

PRINCE, G. A., 2, Willow Grove Road, Leeds.

PARSONS, W., School Board Offices, Leeds.

PAWSON, ALBERT H., Lawns House, Farnley, Leeds.

PEARCE, JOHN, 13, Commercial Street, Leeds.

PALETHORPE, H. J., Albion Street, Leeds.

PRIDE, A., 15, Brown's Place, Hunslet, Leeds.

RYDER, CHAS., Gledhow, Leeds.

REYNOLDS, R., Cliffe Lodge, Hyde Park, Leeds.

ROBINSON, THOS., Morris Wood Cottage, Kirkstall, Leeds.

ROEBUCK, W. D., F.L.S., 259, Hyde Park Road, Leeds.

ROWLEY, WALTER, Alder Hill, Meanwood, Leeds.

REDMAYNE, JOHN, Grove House, Grosvenor Road, Leeds.

RUMBOLL, S., Hope Villa, Woodhouse Lane, Leeds.

STUBBINS, J., F.R.M.S., F.G.S., Woodlands, Pool, Leeds.

SCARR, Alderman A., Clarendon Road, Leeds.

SMITHILLS, Prof. A., B.Sc., F.I.C., North Grange Road, Headingley, Leeds.

SIMPSON, Miss, 35, Kensington Terrace, Leeds.

SMITH, E. B., 1, St. Chad's Villas, Headingley, Leeds.

SIMPSON, J. H., Heights House, Heights Lane, Armley, Leeds.

SIMPSON, T. H., 54, St. Michael's Road, Leeds.

SHELFORD, R., B.A., Yorkshire College, Leeds.

TREVELYAN, Prof. E. F., M.D., B.Sc., 40, Park Square, Leeds.

THIRIPPLETON, J., Bond Chambers, Infirmary Street, Leeds.

TAYLOR, T. H., M.A., Yorkshire College Leeds.

THORNTON, T. W., 47, Reginald Terrace, Leeds.

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THORPE, H. W., Moorland Terrace, Leeds.

VERITY, E., Sholebroke Avenue, Leeds.

WHITHAM, THOS., Bramhope.
 WHITEHOUSE, E. E., Clarendon Road, Leeds.
 WALKER, ARTHUR, 2, Regent Park Terrace, Headingley, Leeds.
 WILSON, RICHARD, Westfield, Armley, Leeds.
 WILSON, H. B., Westfield, Armley, Leeds.
 WILSON, L., Westfield, Armley, Leeds.
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 WAGER, HAROLD, F.L.S., Bank View, Chapel-Allerton, Leeds.
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 WHITE, ALF., F.Z.S., Derwentdale, Oakwood Avenue, Leeds.
 WILSON, Miss J., 160, Otley Road, Leeds.
 WALKER, H. SECKER, F.R.C.S., Park Square, Leeds.
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 WALTERS, R. H., Nethway, Harrogate.
 YOUNG, McGREGOR, M.B., M.C.L., Woodhouse Lane, Leeds.



5.145.

No more received.



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LIST OF PAPERS AND MEETINGS,

ABSTRACTS, ETC.,

AND

LIST OF MEMBERS.

1898.

VOL. IV.

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PREFATORY NOTE.

The Annual Report for 1898 shows that the number of members on the roll is at present 139, of whom 14 are honorary members. The financial condition of the Club continues to be satisfactory. The Council express their thanks to Messrs. George Parkin, G. Paul, F.G.S., and the Rev. W. T. Travis, M.A., for their interesting papers, and to Messrs. T. H. Rhodes, C.E., and Hiscoe for their exhibition of Fossils. They record with great regret the death of Mr. E. B. Smith, one of the Hon. Secretaries, who had distinguished himself by his thoughtful work and keen enthusiasm for Science.

FEBRUARY, 1899.

LIST OF OFFICERS FOR 1898.

President:

JAMES W. ADDYMAN, B.A.

Vice-Presidents:

H. B. HEWETSON, M.R.C.S., F.L.S., etc.

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JOHN STUBBINS, F.G.S., F.R.M.S.

E. F. TREVELYAN, M.D., B.Sc., etc.

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T. H. TAYLOR, M.A. R. N. MIDDLETON.

Hon. Treasurer:

J. PHILLIPS.

Hon. Librarian and Curator:

OLIVER MARSDEN.

Hon. Secretary:

H. B. WILSON.

LIST OF PAPERS, 1898.

Feb. 18. The Work and Objects of a Naturalists' Club.—The President (J. W. Addyman, B.A.).
 [The Presidential Address for 1898. Attention was called to the valuable work which may be done by such societies in local Natural History, and the methods by which such work could be done in the most effective manner.]

Mar. 4. The Rearing and Preservation of Insects.—George Parkin, *President of the Wakefield Naturalists' Society*.
 [The paper dealt with the search for insects, localities for the different genera and species; methods of breeding; for ordinary purposes an ordinary flower pot, with muslin cover fastened with an elastic band, the stem of the food plant, wrapped round with cotton wool, being passed through the hole in the bottom of the pot into a jam pot full of water. Methods of setting insects and collections were also described. See "Leeds Mercury Supplement," March 12th, 1898.]

,, 18. How to Use a Microscope; a Practical Demonstration.—F. W. Branson, F.I.C., F.C.S.
 [The theory, history, mechanics, and manipulation of the microscope were dealt with, and illustrated by diagrams, lantern slides, microscopes, and other instruments.]

April 1. The Structure of *Euglena viridis*.—Harold Wager, F.L.S.
 [A general account of the Structure and Life History of the Organism.]

,, 15. The Root Tuberles of the Leguminosæ.—Norman Walker.
 [A general account and summary of the chief researches which have been made. See "Leeds Mercury Supplement," April 23rd, 1898.]

May 6. How Muscles Move and Feel.—Professor de Burgh Birch, M.D.
 [The structure of muscle and nerve; the connection of nerves with muscle, and the relation of one to the other as regards function were described. See "Leeds Mercury Supplement," May 14th, 1898.]

,, 20. A Practical Zoological Demonstration.—T. H. Taylor, M.A.
 [See "Leeds Mercury Supplement," May 28th, 1898.]

Oct. 12. 1. A Shell, *Physa neterostropha*, new to Britain.—W. Nelson.
 [This shell was discovered by Mr. James Madison in a large pool near Birmingham. It differs from *P. fontinalis* in the digitations of the mantle. It is the commonest species of *Physa* in America, and has a range from Texas and Georgia as far north as the great slave lake and from the Atlantic to the Pacific.]

2. A Plant, *Nitella hyalina*, new to Britain.—H. Crowther, F.R.M.S.
 [Discovered near Helston, in Cornwall. It is a continental form, but of rare occurrence everywhere.]

3. Notes on *Botrydium granulatum*.—Harold Wager. [See pages 9-16.]

4. Exhibition of *Geranium pyrenaicum*, *Alchemilla alpina*, and *Reseda*.—The President.

5. Photographs of Birds and Birds' Nests.—Rev. W. Travis Travis, M.A.
 [An exhibition and description of an extremely interesting collection of photographs made by Mr. Travis in various localities, including the Rock of Handa, near Cape Wrath, on which it is estimated fifteen million birds nest annually; the Farnes; the Orkneys; Flamborough Cliffs and Norway; and of smaller English birds in Nidderdale.]

6. Hematite with curved crystals of Carbonate of Lime, covered with a thin deposit of Chalybite.—The President.
 [Mr. Crowther described this as a very interesting specimen, the curved crystals being excessively rare.]

7. Some Fossils from Gildersome Tunnel.—J. H. Rhodes, C.E., and Mr. Hiscoe.
 [An exhibition and description of some unusually fine fossils from the workings of Gildersome Tunnel.]

8. Minerals from Colorado.—J. Thriplleton.

Nov. 2. The Causes of Weather considered in Relation to their Indications.—George Paul, F.G.S.
 [See "Leeds Mercury Supplement," Nov. 12th, 1898.]

,, 16. Some Recent Discoveries in Physical Science: a Practical Demonstration.—F. W. Branson, F.I.C.
 [See page 8 and "Leeds Mercury Supplement," Nov. 26th.]

Dec. 7. A Fungus Parasite of *Euglena*.—Harold Wager.
 [A description of the structure and life history of *Polyphagus euglenae*.]

ON A METHOD OF MEASURING THE INTENSITY OF THE X-RAYS.

F. W. BRANSON, F.I.C.

OWING to the fact that aluminium is comparatively transparent to the X-Rays, the following method was devised as a convenient one for estimating the intensity of these radiations.

The method is believed to be the first devised for this purpose. The instrument, which is called an X-Ray meter, consists of a plate of aluminium, on which are superimposed a series of steps of the same metal, each step being 1 mm. in height.

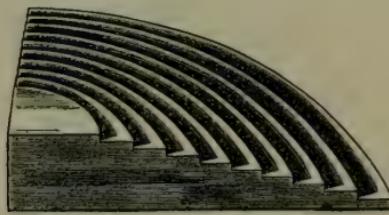


Fig. 1. X-Ray Meter.

To take an observation the instrument is superimposed between an X-Ray tube and a fluorescent screen; the shadows of a series of steps, varying in number according to the intensity of the radiations, may then be counted.

A photographic plate enclosed in a light-tight envelope may be substituted for the fluorescent screen, and a time exposure given.

The shadows of the steps will then be registered on the photographic plate. By the above means various forms of apparatus may be easily compared as to intensity.

NOTES ON *BOTRYDIUM GRANULATUM* GREV.

HAROLD WAGER.

GENERAL STRUCTURE AND HABIT.

Botrydium granulatum is the simplest member of the group of Siphoneæ, to which *Vaucheria* belongs. It grows on damp, clayey soil or on damp mud, where it forms masses of green spherical vesicles about 2 mm. or less in diameter. These vesicles contain a dense layer of protoplasm lining their walls, coloured deep green by a large number of green chromatophores or chlorophyll bodies which are present. The vesicles are rooted to the ground by an extensive branching system of colourless rhizoids which contain protoplasm but no chromatophores. Under conditions of drought the contents of the vesicles may retreat into these rhizoids, where they become rounded off into separate green cells which are capable of reproducing the plant when brought under the proper conditions.

The plant, therefore, can be found above ground only under the most favourable conditions as regards moisture, and it is for this reason, probably, that so few records of it, so far as I can ascertain, have been made in England.

It is, in fact, so sensitive to the environment that it can exist under several conditions, and is capable of different methods of reproduction according as the conditions of the environment are varied.

MICROSCOPIC STRUCTURE.

According to Schmitz both the protoplasm in the green vesicle above ground and in the colourless rhizoids below contain very numerous nuclei, but he has given no description of their structure.*

* *Sitzungsberichte der niederrheinischen Gesellschaft in Bonn*, 1879-1880.

To see the nuclei distinctly the plant may be first of all killed and hardened in absolute alcohol or Flemmings' chrom-osmium-acetic solution, then washed in water and stained in a dilute solution of haematoxylin or in Meyer's acid carmine for some time, then cleared in the usual way and mounted in balsam. We then find, both in the protoplasm lining the spherical vesicle above ground and in the rhizoids, that the nuclei possess a distinct nuclear membrane and a deeply stained nucleolus. The chromatic substance appears to reside wholly in the nucleolus. In the green portion of the plant the nuclei are in close contact with the chromatophores, and in the majority of cases each chromatophore possesses one nucleus in close contact with it. In some cases a nucleus is found in contact with two chromatophores, rarely with three or four.

The division of the nucleus has been observed in the rhizoids. The nuclear membrane disappears, the chromatic substance forms a number of chromosomes, which arrange themselves into an equatorial plate, with a nuclear spindle. They then separate into two equal groups, which become transformed into daughter nuclei. The process does not appear to differ in any essential from that observed in the higher plants, except that no longitudinal splitting of the chromosomes could be observed. This may be due to their small size, which prevents all the details of nuclear division from being accurately observed, or it may be that no longitudinal splitting occurs. The chromatophores are large, irregular in shape, and more or less equally spaced in the living layer of protoplasm. In sections, cut with the ribbon section cutting microtome, they were found to occur in layers one, two, and sometimes three deep, according to the stage of development of the plant.

REPRODUCTION.

We owe to Rostafinski and Woronin* our knowledge of the somewhat complicated life history of this plant. It reproduces itself, according to these observers, both asexually and sexually, and is also capable of vegeta-

* Ueber *Botrydium granulatum*, Botanische Zeitung, Vol. 35, 1877.

tive reproduction. The varying conditions under which the plant may be placed of dryness, moisture, light or darkness results in some variation in the process of reproduction.

ASEXUAL REPRODUCTION.

This takes place by the formation of zoospores, which may be produced in various ways.

1. If the ordinary vegetative plant be brought into water, its protoplasmic contents divide up into numerous zoospores, each containing one or two chromatophores and a nucleus. These escape through an opening at the apex and swim away by means of a single cilium placed at its anterior end. The whole plant is thus converted into a single sporangium.
2. If the plant instead of being placed in water be only wetted, the zoospores do not swarm out of the sporangium, but remain inside it, round themselves off, and ultimately develop into new plants. These were called germ-cells or gonidia by earlier observers.
3. If the soil becomes dry at the surface the contents of the green portion above ground pass down into the rhizoids to form a large number of root-cells. These may develop in three ways.
 - a. If placed in water they develop zoospores at once.
 - b. If placed on damp earth in the light they do not form zoospores, but, instead, each root-cell puts out a rhizoid and develops into a vegetative plant directly.
 - c. If kept inside damp earth—in the dark, therefore—the root-cells swell up and put out rhizoids. The wall of the rhizoid just below the cell becomes much thickened, and by its growth in length the cell is carried up to the surface of the earth. This cell is known

as a hypnosporangium ; it is about .5 mm. in diameter, and is dark olive green in colour, and possesses a thick cell wall. These hypnosporangia, if kept dry, may remain unchanged for a long time, but if placed in water they develop zoospores at once.

SWARMSPORES.

The swarmspores or zoospores can move very rapidly through the water by means of the single anterior cilium. They are sensitive to the light, being attracted towards it when it is not too strong, but are repelled by an intense light. The result of these movements is that when they come to rest the zoospores are in a position to make use of the light for the process of assimilation, and are able to provide themselves with a cell wall and develop into new plants.

The germination of the zoospores, whether derived from ordinary sporangia (1) (2), from root-cells (3a), or from hypnosporangia (3c) is the same. When the zoospore comes to rest it rounds itself off and increases in size ; the chromatophores and nuclei increase in number by division, and the plant puts out a delicate rhizoid which remains unbranched for some time. The upper green part may, however, become branched, sometimes very considerably. In this condition the plant is capable of further development in several different ways, according to the environment.

- I. It may reproduce itself vegetatively by budding. A new vesicle grows out from the aerial part of the plant, which puts out rhizoids into the earth and finally becomes isolated from the mother plant.
- II. If the small vegetative plants be placed in water the contents become divided up into zoospores.
- III. The young vegetative plants gradually develop into ordinary plants with branched rhizoids—especially if they are grown on damp clay and not too crowded together. They ultimately produce zoospores, as described in 1, 2, and 3.

iv. The young vegetative plants may become converted into hypnosporangia directly if the conditions are unsuitable for either of the above.

The zoospores produced in II. from the young and immature plants may differ slightly in their subsequent development from those produced in the ordinary way.

- A. If placed on ordinary damp earth or sand, they produce only small plants with branched rhizoids—ordinary zoosporangia.
- B. On clay or slime they develop into the ordinary vegetative plants.
- C. If kept in water they do not develop at all, and if spores which have already come to rest are brought into water they surround themselves with a thick membrane and remain in this condition for months. If they are placed on damp clay again the cells escape from their thick membranes and develop into much branched vegetative plants.

SEXUAL REPRODUCTION.

According to Rostafinski and Woronin, sexual reproduction takes place by the pairing of motile biciliate cells, but Klebs has recently shown, however, that there are probably two organisms involved in this life history,* and that the sexual forms do not belong to *Botrydium*.

LOCALITIES AND NOMENCLATURE.

The first notice of the plant is given by Ray† in "Synopsis methodica stirpium Britannicarum. Londin. 1690. III., p. 70 and 41," who refers to it as "Lichenoides fungiforme, capitulis vel vesiculis sphaericis aqueo humore repletis."‡ Since then it has been described under several different names. The name *Botrydium* was given to the genus in 1815 by Wallroth, and in 1830 the plant was described as *Botrydium granulatum* by Greville.

* Die Bedingungen der Fortpflanzung bei Einigen Algen und Pilzen. Jena, 1896.

† See Rostafinski and Woronin loc. cit.

‡ Lichen like fungus form, with spherical heads or vesicles full of aqueous humour.

It has not, so far as I am aware, been recorded for many localities in England. This may be due to some extent to its very small size and insignificant appearance, partly to the fact that it is extremely susceptible to dryness, disappearing beneath the surface of the soil as soon as it becomes at all dry. It seems to require for its development above ground that the soil should be just in the right condition as regards moisture, being neither too damp nor too dry.

I have found it in the following localities :—

1. Winsford, Cheshire. On the drying up sediment of the filter beds. 1889.
2. Near Bristol. On the drying up mud left by a roadside pool. 1891.
3. Chapel Allerton, Leeds. In my garden at Bank View, on a damp clayey soil all over the garden. 1898.
4. Near Banwell, Somerset. On the drying up mud left by a small roadside pool.

Other localities have been recorded in recent years by Mr. Wm. West, F.L.S., Mr. Wm. West, jun., B.A., Prof. F. W. Oliver, and Mr. Abbott.

5. Kew Gardens. Collected by Prof. Oliver. (This record was sent to me by Mr. A. W. Bennett, M.A.)

Mr. Wm. West, F.L.S., gives the following :—

6. On the drying up mud taken out of the Leeds and Liverpool Canal.
7. Adel, near Leeds. On the upper dam. (Collected by the late Mr. Abbott, of Leeds.)

Mr. Wm. West, jun., B.A., gives the following localities :—

8. Swaffham Prior side of Newmarket Heath. On drying chalk mud in a lane. 1895.

9. Esher West End Common, Surrey.

I am also indebted to Mr. West, jun., for information concerning some of the earlier records. Mr. West

writes:—"There are hardly any records for this Algae. Hassall dismisses it as 'common,' and Cooke gives no localities, neither does Jenner in his excellent 'Flora of Tunbridge Wells.' In the herbarium at the British Museum there are only two British localities represented":—

10. *Botrydium granulosum*. Salcombe Regis, Sept. 25th, 1840, R.C. Herb. Catherine Cutler.
11. *B. granulata*? In the great bog on the Forest. Edw. Forster's Herb. (By "the forest" Epping Forest is doubtless meant, as Edward Forster lived at Woodford, and the locality is in his own handwriting.)

In the "Flora of Leicestershire" Mr. Mott gives the locality:—

12. On damp, clayey soil, margins of Groby Pool; at Birstal (Mott).

It is probably very much commoner than these records indicate, and I should be very glad to hear of any other localities in which it has been found.

NEW MEMBERS ELECTED 1898.

B. T. STOKOE, M.B., B.S., B.Hy., Burley Lodge, Leeds.

JAMES BRAND, F.R.C.V.S., De Grey Terrace, Leeds.

L. J. COCKS, 1, East Parade, Leeds.

Rev. A. E. MEREDITH, The Vicarage, Pool.

THOS. LISTER CROFT, South Parade, Pudsey.

JOHN GRIMSHAW WILKINSON, 5, Carberry Terrace, Burley Lodge Road,
Leeds.

JOHN B. HELLIER, M.D., De Grey Terrace, Leeds.

